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COMMERCE OF ANTWERP.

[The Exchange, Antwerp.]

ONE of the most fruitful sources of interest to which an historian, at once accurate in details and philosophical in his general views, could direct his attention, would be the vicissitudes of commerce, and the causes which have successively rendered first one place and then another the chief marts of the trade and industry of nations. Such a subject, instead of being far removed from the common direction of human sympathies, is closely allied with them. To trace the early dawning of national industry amongst any people, to estimate the benefits which it more or less diffuses, the sordid habits of existence out of which it raises them, and the comforts and wealth which are supplied in its advancing course,—and then to picture an ensuing period of decline, of the decay of individual fortunes, and of the fall and final extinction of national greatness, until the places which once resounded with the voices of busy and active men are visited only in long-after ages by the curious traveller who explores their scattered ruins in search of relics of their former splendour;—these successive changes of human interests suggest to the imagination considerations which are strongly affecting. But there is this consolation in reflecting upon the apparent fickleness of commerce, that it has generally been the folly and blindness of men which have driven her from place to place, though they choose to fix the blame upon some inherent cause from which it would be useless to expect stability. Those fluctuations which are to be attributed to natural causes—to some newly discovered path to the richest producing countries—though they may have occasioned local effects of a trying nature, have always been the means of developing and extending more widely the advantages of commercial intercourse. As men become more enlightened in their general views we may expect fewer instances of commercial vicissitude; and the principal causes which have most powerfully contributed in past times to bring about changes in the direction of trade must at all events exercise a smaller degree of influence than they have hitherto done.

England was almost the last amongst European nations in obtaining its proper share of commerce. How far it now outstrips them in this respect it is not necessary to show at present. We were preceded by the Hans Towns, the French, the Venetians, the Flemings, Portuguese, and

Dutch, who each enjoyed at various intervals a considerable portion of foreign trade while that of England was insignificant or had scarcely any existence. Foreign wars, internal dissensions, and ill-judged restrictions restrained the nation from pursuing a course so well adapted to its position and the character and energy of its population. In the fourteenth and part of the fifteenth centuries the Netherlands was the principal seat of European commerce. Bruges had long been the emporium of trade and the great depôt for the productions of the north and south of Europe. The spectacle of industry and its attendant wealth and splendour which presented itself to the traders who frequented Bruges from every quarter of Europe, furnished a useful lesson on the advantages which the arts of useful life were capable of conferring, and might have the effect of diverting neighbouring sovereigns, who wasted their resources in war, to more gainful and peaceful courses. Sluys was the seaport of Bruges, from which, by a fine canal about nine miles in length, vessels were enabled to unload in the heart of the city. In 1482, in consequence of some dispute between the bourgeois of Bruges and the Archduke Maximilian, the port of Sluys was blocked up, and the sources of the wealth of Bruges were seriously injured. The great trade of which it had been the centre was transferred to Antwerp, which had long been only inferior to itself in commercial importance, and which possessed greater natural advantages. It was 45 miles from the mouth of a fine tide-river which also commanded a considerable extent of back country, and was convenient to navigators arriving either from the north or south of Europe. Before the commerce of Venice had become of importance, Antwerp had traded in the productions of the East with the ports of the Baltic and Russia, where they had been brought overland by the Black Sea. After the Crusades, these productions found their way to the west through the Mediterranean, and this circumstance gave the commerce of Venice its temporary supremacy. When the passage to India by the Cape of Good Hope was discovered, Venetian commerce necessarily declined. But under all these vicissitudes the trade of Antwerp continued to flourish. The wisdom of its commercial regulations attracted traders of every country, who, during the great fairs which lasted several weeks, sold their goods free from customs' duty. The Portuguese, who commanded the market for the productions of India, found Antwerp the best place for the disposal of their rich cargoes, and it became the grand central depôt for the natural and manufactured commodities of the East, at which the merchants of Germany and Northern Europe, and those of France and England, were accustomed to make their wholesale purchases, and to bring in exchange the produce and manufactures of their respective countries, which were bought by the Portuguese, Spaniards, Italians, and merchants of the south of Europe. The trade of England with Spain was all carried on through this medium, all Spanish exports being sent in the first instance to the Flemish mart. The English were the largest purchasers of mercery, haberdashery, and groceries of any nation. The competition of buyers and sellers had the most beneficial influence upon the interests of industry, by breaking down the spirit of monopoly. Cheapness was the consequence of free competition, and flourishing manufactures of velvet, satin, and damask were established at Antwerp. Besides the influx of foreigners, the commerce with the interior was of great extent. The merchandise of Hainault, France, Burgundy, Cologne, and Cambray was brought in carts over land. It is said that 2500 vessels have laid before Antwerp at the same time. Various other statements are given for the purpose of showing the extent of its commerce, one of which is, that more business was transacted at Antwerp during one month, than at Venice within a period of two years, during the most active period of her commercial greatness. The population of Antwerp was about 200,000 in the sixteenth century.

The Exchange, a view of which is given in the cut, was built in the year 1531. The dealings of persons of different nations on so extensive a scale rendered such a place of resort necessary; and the interchange of goods naturally led to bills of exchange, which were negotiated with the greatest advantage to all parties at Antwerp. Of so much value was capital when employed in so good a market, that complaints are made by some of our old writers of the Venetian and other merchants buying wool, cloth, and tin, on credit in England, and then selling the goods in Flanders under prime cost; the interest which they received on putting out their money at usury before it became due affording an ample rate of profit on both transactions. The Antwerp Exchange was the first structure of the kind in Europe, and formed the model of the exchanges of London and Amsterdam. It rests on pillars of blue marble, all of them carved, but each in a different style.

The commerce of Antwerp continued in a state of high prosperity until nearly the middle of the sixteenth century, when it received a blow which subsequent events did not permit it to recover. Charles V. having declared war against Francis I., the Low Countries were laid under heavy and oppressive contributions, which led to frequent revolts; and many persons left the country who were amongst the most industrious of its citizens. Afterwards the great contest took place against the power of Spain, in the course of which Antwerp was pillaged (in 1567), and the northern provinces of the Netherlands threw off the tyrannical yoke of that country; but the southern provinces could not accomplish this object. Under a despotism like that of Philip, commerce could not prosper, and the merchants of Antwerp carried their persevering and industrious spirit to a freer and more congenial spot. Those who remained became beggars, and the country endured the most oppressive treatment from its masters for a series of years. In 1585 Antwerp was attacked and pillaged by the Duke of Parma's troops, after having stood a siege. Commanding the mouth of the Scheldt, they blocked up its harbours, and now commerce being completely destroyed, Amsterdam began to rise on the ruins of the trade of Antwerp. By the treaty of Westphalia in 1648, it was stipulated by Spain and Holland that the navigation of the Scheldt should be closed, and under this deadly restriction the port of Antwerp continued until the occupation of the country by the French in 1794. It was Bonaparte's intention to have revived its commercial importance, and immense sums were expended in the construction of docks and other works; but after all, under French rule Antwerp became a military rather than a commercial depôt. The population of the city, after the evacuation by the French, did not exceed 52,000 in 1816, but it now amounts with the suburbs to above 73,000. The treaty of Vienna declares that "the navigation of every river from its source to its mouth shall be free, subject only to certain duties which have hitherto been paid, and these depend on the tonnage and not on the nature of the cargo." Under these favouring circumstances commerce is reviving, and the prospects of Antwerp are more encouraging than they have been for nearly three centuries. The Scheldt is a river of great importance to the welfare and prosperity of Belgium and the adjoining countries. It rises near St. Quentin in France, and passes by Tournay, Ghent, Dendermond, and Antwerp, where it is 1600 feet wide. It is connected with the Meuse and the Rhine, and forms a junction with many canals and navigable rivers, which extend inland navigation to the north of France, the west of Germany, and Switzerland. Ships of the largest burthen come close up to Antwerp, and their cargoes are distributed by numerous canals into the in-

terior. "Goods warehoused *en entrepôt* may be exported on paying a charge of one-half per cent. *ad valorem*."* This arrangement greatly promotes and facilitates commercial operations.

In 1833, the number of vessels entering the port of Antwerp inwards was 974; tonnage 118,524. Of the above number of vessels 384 were from Prussian, Danish, and German ports, 153 from the United Kingdom, 84 from Russian ports, 74 French, 72 United States, 53 Swedish and Norwegian, and 46 Dutch. Above one-half of the total number entered arrived in the months of June, July, August, and September. The number of vessels under 100 tons was 556, while 407 were from 100 to 400 tons, and 11 from 400 to 500 tons. In 1830, the number of ships belonging to the port was 112, of the aggregate burthen of 30,909 tons, and manned by 1557 men. Previous to the Belgian revolution, the shipping had been increasing for several years, and many new vessels were built at Antwerp for the Batavian trade; but on the separation with Holland, several merchants and shipowners left Antwerp with their ships to the number of 40, and settled in Holland. The trade of England with Holland and Belgium has been greater since their separate existence than when they formed only one state. The chief importations at Antwerp are about 20,000,000 lbs. of coffee, 6,000,000 lbs. of cotton, 10,000,000 lbs. of tobacco, and 28,000,000 lbs. of sugar annually. The exports consist of corn, seeds, linen, lace, carpets, tallow, &c.

THE WOOD-CHUCK, OR GROUND-HOG.

[From a Correspondent.]

The wood-chuck, as this animal is commonly called by the Americans, is an inhabitant of that portion of the western hemisphere situated within the middle latitudes. Although it is not generally found north of the St. Lawrence and the Great Lakes, I have occasionally met with it in the southern and western districts of Upper Canada. In Ohio, and the western parts of the states of New York and Pennsylvania, wood-chucks are very numerous; and what I considerable a rather remarkable circumstance is this—that I have invariably found them *more* numerous in those parts of the country that were in a state of being settled, or comparatively *new*, than where the country was much older, and better cultivated. Were they generally found in the solitudes of the forests this circumstance would be the less singular; but since they are rarely met with far into the woods, their numbers in the new settlements are not so easily accounted for.

The wood-chuck is nearly of the size and shape of our badger; and, indeed, its haunts and habits are not dissimilar. It is covered with short coarse hair, of a dirty grey colour, on its back and sides, but underneath the black and turgid skin is nearly bare. Its body is broad and flat, and altogether large for the size of its limbs; for its legs are short and do not possess much muscular power,—consequently its utmost speed is greatly inferior to that of many other animals smaller than itself. However, the economy of nature has endowed it with the power of burrowing in the earth with great facility. Its favourite haunts are underneath the stumps of trees which have been felled several years; or, in the absence of such, under ledges of rock, or in cavities which it forms in banks or declivities.

During the summer season a solitary wood-chuck may sometimes be seen in a retired grassy meadow, feeding upon the young clover-plants and other succulent grasses. But during the day it hardly ever ventures to the distance of a gun-shot from its burrow, to which, on the slightest indication of danger, it immediately retreats. Man appears to be this animal's only enemy; although dogs may be taught to hunt them, and to attack them in their lairs; and there certainly is less to tempt us to make war upon the wood-chuck than almost any other wild animal. Many of the old farmers are of opinion, however, that it principally feeds upon the *roots* of clover and other grasses, to the no small injury of those lands but recently laid down to grass; but notwithstanding that opinion,—as I had fully my share of these animals upon my own farm, and devoted as much time and observation to their general habits as any of my neighbours,—candour compels to say that I never detected them in the misdemeanor here laid to their charge. For my own part I used to consider the wood-chuck of no value whatever; for although the skin is thick and tough, the only use I have known it applied to was that of its being cut into strips suitable for "hangings" for the flails that are used in thrashing out the grain. To be sure, some persons dress and cook it, and pronounce the meat "passing good;" but although I have several times been induced to taste "stewed wood-chuck," which was pronounced to be in excellent condition, I must confess that I never found it "quite to my taste;" for the meat, when dressed, is coarse in grain, of a dark colour, and has, in my opinion, a strong and peculiar flavour. I had a favourite dog that, from having imbibed early prejudices, was a great enemy to these inoffensive creatures. I have known him toil throughout a whole summer-day in vain endeavours to unearth some old and cunning wood-chuck, while at other times I have known him bring home his victim at the expense of comparatively little labour. But since they were food neither for my canine friend nor the family, I have often wondered why he took so much trouble to capture so worthless a prize.

The bite of the wood-chuck, like that of the badger, is very severe; for their jaws are so powerful that the teeth will make distinct impressions upon the edge of a hoe or spade, or other implement inlaid with hardened steel. When attacked in a hole that does not allow them much chance of escaping, they utter, at short intervals, a peculiar quick and shrill whistle, which, as far as I am able to judge, is an indication of alarm,—and not, as many persons have imagined, a burst of anger or passionate rage.

The wood-chuck, like bears and some other animals, remains in a dormant state during the long winters; for it is not until spring has fairly set in that it may be seen cautiously stealing from its winter-quarters. Many animals (squirrels, for instance) lay up stocks of provisions to subsist upon during the inclement season, when it would be impossible for them to be abroad; but the wood-chuck seems not to require such a precaution, since in their winter retreats I have never found more than a mere handful of dry grass—a very inadequate supply of provender for several months,—and only intended, I am inclined to suspect, as a bed upon which to slumber away the long and dreary season.

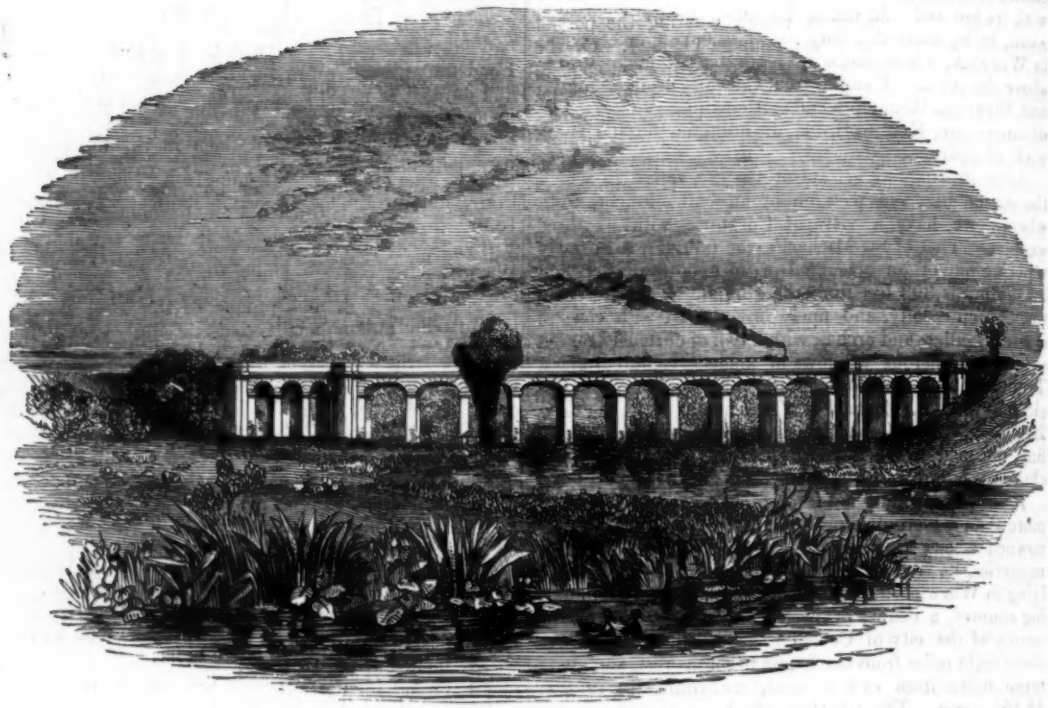
On their re-appearance in spring, at the first they are lean and haggard; but as the warm season advances vegetation rapidly, they soon acquire their wonted strength and plumpness.

Necessity of Instruction in Rural Districts.—A little consideration of the nature of rural life will show the danger of leaving the peasantry in a state of ignorance. In the solitude of the country, the uncultivated mind is much more open to the impressions of fanaticism than in the bustle and collision of towns. In such a stagnant state of existence the mind acquires no activity, and is unaccustomed to make those investigations and comparisons necessary to detect imposture. The slightest semblance of evidence is often sufficient with them to support a deceit which elsewhere would not have the smallest chance of escaping detection.—Mr. Liardet's *Report on the State of the Peasantry in Kent.*

* M'Culloch's 'Dictionary of Commerce.'

LONDON AND BIRMINGHAM RAILWAY.

[Continued from No. 411.]



[Viaduct over the Upper Avon.]

RUGBY station is 83 miles from Euston Square, and 29 from Birmingham. An act was passed, in 1836, "For making a railway, with branches, commencing at the London and Birmingham Railway, in the parish of Rugby, in the county of Warwick, to communicate with the towns of Leicester, Nottingham, and Derby, to be called the Midland Counties Railway." But now we start from Rugby for Birmingham. For about 7 miles the line of the Railroad is carried through and over an alternation of short cuttings and embankments, the character of the ground varying every mile. We pass three or four villages or hamlets, Bilton, Church Lawford, Brinklow, &c. From Weedon in Northamptonshire we have been carried north-west to Rugby, on the eastern extremity of Warwickshire; but from Rugby we are carried south-west and north-west alternately, the line curving gently right across the fine county of Warwick to Birmingham, which lies on its north-western edge. This county is one of the most central in England. Its woodlands, the remains of the wide ancient forest of Arden, are still extensive, and its plains are diversified by hills and rivers. The forest of Arden "is said to have reached from the banks of the Avon to the Trent on the north, and to the Severn on the west; and to have been bounded on the east by an imaginary line from Burton-upon-Trent to High Cross, the point of intersection of Watling Street and the Fossway on the border of Warwickshire and Leicestershire. Drayton, in his 'Polyolbion (the 13th song), says—

> 'That mighty Arden held, even in her height of pride,
> Her one hand touching Trent, the other Severn's side.'

"Upon the division of England into shires, this immense wild was divided between different counties, and only that part which was included in Warwickshire retained its name."* We are now therefore travelling through a portion of a district once peopled by the bear, the wolf, and the wild boar; and instead of Britons rushing out on their antagonists in their war-chariots, with a "trampling of the horses and a rolling of the wheels," there is the hiss of the steam-engine, and the rattling noise of the train. The changes of civilization have hitherto been slow, but are they not now sure?

Twenty-three miles from Birmingham we are carried across the Avon by a handsome viaduct of fifteen arches, of which a view is given above. Here also is the hamlet of Brandon, and some ruins called Brandon Castle. The Avon has a picturesque appearance from the Railroad. There are a number of rivers bearing the common name of Avon, in England, Wales, and Scotland; but this is that Avon which is known wherever the English language is spoken, by its association with the name of Stratford, and that again with Shakspeare's. This Avon, called the Upper Avon, to distinguish it from the Lower Avon (which comes down from Wiltshire, and flows past Bath and Bristol into the Bristol Channel), rises from a source called Avon Well, in the village of Naseby in Northamptonshire, and after forming a boundary for some distance between the counties of Northampton and Leicester, flows past Rugby, skirts the line of the Railroad at some little distance, passes under it, goes on to Warwick, Stratford-on-Avon, and ultimately joins the Severn, after a course of about an hundred miles. "The stream of the Avon is gentle, and its banks interesting and beautiful, though occasionally flat."

Between four and five miles farther on is the Coventry station, in coming to which we get a momentary peep at the far-famed spire of St. Michael's. Coventry station, eighteen miles from Birmingham, is about a quarter of a mile from the town; it lies in an excavation, the banks of which preclude all view; but there is a bridge thrown across the Railroad, and the traveller may amuse himself with the contrasts afforded by the groups gazing over the parapet-wall, as if the train and its occupants belonged to another sphere. This bridge across the Rail-

* 'Penny Cyclopædia,' vol. v

road connects the high road from Coventry to Kenilworth, with its dismantled and ruined castle, associated with the names of Elizabeth, Leicester, and Scott; to Leamington, with its hot and cold baths, its inns, theatre, assembly-room, balls, water-drinking, and fashionable gaiety; and to Warwick, whose castle in renovated grandeur towers above the Avon. Coaches from Coventry to Leamington and Warwick through Kenilworth run every day. The distances are, Kenilworth 4½, Leamington 8, and Warwick 10 miles.

After starting, we get out of the excavation in which the station lies, and pass on to an embankment, from whence we have a view of Coventry, with its three steeples. That of St. Michael's, the tallest, "rises finely tapering out of an octagonal prism upon the tower, and its summit is 303 feet from the ground. The interior of the church is lofty, and finely ornamented with rows of clustered pillars and arches, with a roof of curiously carved oak, and numerous windows of ancient coloured glass. Trinity Church is a Gothic edifice, but heavier and less elegant than St. Michael's. The height of its spire is 237 feet." St. Michael's steeple is unquestionably very fine, affirmed to be one of the finest in Europe. The church was originally built in the reign of Henry I.

Railroad travelling is far too rapid to permit us to take more than a mere passing notice of so venerable and renowned a city as Coventry—its legends and dramatic mysteries, its ribbons and its watches. The city, though lying in Warwickshire, forms, with a portion of surrounding country, a county of itself, under the name of the county of the city of Coventry. The county measures about eight miles from north-east to south-west, and about seven miles from east to west, containing an area of 18,161 acres. The parishes which compose the county have no share in the civil and political privileges of the city. The city itself, though containing some fine buildings, and interesting to a person of an antiquarian taste from the number of old houses contained in it, has a crowded, heavy look. We need hardly repeat the well-known facts, of Coventry having been famous for its exhibitions of rude dramas, called religious, because taken generally from biblical subjects, and mysteries, as dealing with the most sacred matters; or how kings, queens, nobles, and prelates used to "witness with gratification and applause what would now shock the feelings and be condemned by the humblest member of society." And as little need we mention that "the peculiar predilection of the people of Coventry for gorgeous pageantry is still displayed in the celebrated processional show at the great fair on the Friday in Trinity week, when many thousands assemble to see the representative of lady Godiva," and be reminded of the disaster of Peeping Tom.

Coventry has been the seat of two parliaments; and here was held the wager of battle between the Duke of Hereford (afterwards Henry IV.) and the Duke of Norfolk, which was stopped at its commencement by Richard II., who banished the two noblemen—one of them shortly afterwards depriving Richard of his crown, and consigning him to prison.

The chief manufactures of Coventry are those of ribbons and watches. The population of the city, which is both a municipal and a parliamentary borough, sending two members to Parliament, amounted, in 1831, to 27,070.

By this time we have got rapidly on our way to Birmingham. Kenilworth lies to our right; and about four miles from Coventry (14 from Birmingham) we pass through an excavation, the sides of which are steep, and over which a handsome bridge is thrown, connecting the high road from Coleshill to Kenilworth. A few yards farther on is Beechwood Tunnel, the only tunnel between Rugby and Birmingham. This is carried through some high ground which interrupts the line of the Railroad at Reeves Green, near the village of Berkswell. Passing Berkswell Park, the seat of Sir Eardly Wilmot, we are carried by a viaduct across the river Blythe, an affluent of the Tame, which is a branch of the Trent. The steeple of Coleshill church is now for several miles a conspicuous object. Coleshill, an antient market-town, on a hill, is intersected by two coach roads, connecting Warwick and Birmingham with Tamworth, Lichfield, &c.; the line of the Birmingham and Derby Junction Railway is marked as passing near it, on its course from Tamworth to join the Railway we are travelling on, close to Birmingham. The act for the Derby and Birmingham Junction Railway was passed in 1836.

Birmingham, as has been stated, is on the edge of Warwickshire, close to Staffordshire; but a small narrow portion of Worcestershire, looking in the map like a pointed finger, projects into Warwickshire; and this we cross on our way to the "toyshop of Europe." In crossing this strip we pass, at a little distance, the large village of Yardley in Worcestershire. Birmingham now opens on our view, but we are approaching it by, perhaps, one of its worst-looking suburbs. Numerous shafts remind us that we have come to a region of brick and iron and steam: but though nobody is disappointed because Birmingham exhibits external tokens of all that gives it wealth and importance, the traveller who sees it now for the first time must suspend his opinion of its general appearance till he arrives, and, quitting this somewhat squalid-looking quarter, gets into the heart of the town. As we approach, the line of the Grand Junction Railway is seen curving round to the north-west; and presently we are landed in the Birmingham Station of the London and Birmingham Railway, in "Nova Scotia Gardens."

We may now take a rapid glance at the road we have travelled in coming from London to Birmingham. Starting from Euston Square, we ascend to the Camden Town Station, where the Company have about thirty-three acres of land as a depôt for the buildings, engines, waggons, goods, and various accessories of the carrying department of the Railway. From Camden Town we go through an excavation, about six miles in length, which includes the Primrose Hill Tunnel; and by it and the Kensall Green Tunnel we clear the high ground outside of London. Then we traverse a valley, a portion of the London basin, and over the "London clay," carried on an embankment, till we meet the high ground on the borders of Middlesex. We are carried *over* this high ground, and pass into Hertfordshire. Another valley meets us, the Colne valley, and then the Watford Tunnel; from thence we ascend to the "summit level" at Tring, and are carried through a portion of the chalk hills which here cross our path. Continuing along through Buckinghamshire, skirting for a time the edge of Bedfordshire, we arrive at Denbigh Hall, and from thence pass the Wolverton viaduct, and along the great embankment thrown across the flat valley of the Ouse. At our entrance into Northamptonshire we are met by the oolitic ridge of hills, and are carried through it by an open excavation of several miles, where the engineer had to contend with the "water and the rock," and the unforeseen difficulties of which caused the contractor to throw the "costly works" on the Company's hands. From the Blisworth ridge we cross the valley of the Nen, which includes much of the pleasing hilly country of Northamptonshire; we are next carried through a tunnel, and past Weedon Beck, with its barracks and its military depôt; and shortly afterwards arrive at the stupendous Kilsby Tunnel. This tunnel, taken through the high ground that skirts the boundary of the counties of Northampton and Warwick, and the highest ground to be passed on the whole route, has been as serious a work as the Blisworth contract. "An extensive bed of quicksand, lying over nearly one-fourth of the whole length of the tunnel, and requiring to be drained by powerful steam-engines," while "other

parts of the tunnel abounded in water, rendering it necessary to increase the number of shafts to an extent which could not have been foreseen," all caused the work to be one both of expense and delay. From Kilsby Tunnel we pass Rugby, and traverse the valley of the Avon, crossing the river by the viaduct represented in the wood-cut at the head of this article; and after passing Coventry get through the last ridge of high ground that meets us on our way to Birmingham, passing it by a short tunnel called the Beechwood Tunnel. We now get near to Birmingham, crossing the Blythe; and after running a length of 112 miles, over a country which at first sight would seem to present no great difficulties to the construction of a railroad, for neither mountains nor marshes have lain in our way, but which, from its incessant alternation of hill and valley, and the varied nature of the strata, has in reality severely tested the greatest engineering skill, and tried the resources of the Company, we arrive at the Birmingham station, immediately outside of Birmingham, where there is a space of about ten acres, appropriated to the buildings, &c. necessary for the reception of passengers and goods.

[To be concluded.]

INVENTION AND PRESENT STATE OF PRINTING IN CHINA.

BEFORE the time of Fo-hi, says a Chinese writer, the central government published its manifestoes by means of a certain number of interlaced threads or cords, resembling the "Quippos" of the Peruvians, which had a particular signification according to the number of knots or the manner of braiding. Fo-hi first invented the eight *Kua*, the basis of the religion and legislation, as well as of the written character and literature of the Chinese empire. Great attention was now given to the sciences; at least from the time of the third dynasty, that of Tscheu. Though the greater part of the old Chinese literature was subsequently destroyed, yet, under the dynasty of Tang, there were as many and extensive libraries to be found in China as in any other part of the world during the sixth, seventh, and eighth centuries. The emperor, the higher and inferior officers of state, the literati, and the various scientific and ecclesiastical institutions, possessed considerable libraries, which are severally enumerated in the literary division of the Chinese "Encyclopædia of Matuanlin," in the 174th book. At that period China possessed a collection of not less than 80,000 volumes on the various branches of literature and science. These works were of course very expensive, and Matuanlin says, that whoever possessed a collection of books was regarded as a distinguished person. There were but few copies of the larger works, and great difficulty was found in communicating their contents throughout the empire by means of oral instruction. The distinguished individual who first discovered a remedy for all these deficiencies, and who is still looked upon by all the printers and bookbinders of the empire as their patron, was Fong-tao, who flourished in the first half of the tenth century of our own æra.

There is no record of the date of his birth, which took place in the city of King, in the district of Ho-kien, and in the department of Pe-tache-li. His early occupation was agriculture; nor did he devote himself to the sciences till late in life. By his talents and merits he gradually rose to higher offices in the state, and received an appointment at the court of the emperors of the later or Tartar Tang dynasty. In the reign of Ming-tsong (927-934) Fong-tao had the principal and, as they were called, classical works, cut out in stone plates, which had been done several times during the preceding dynasties, and obtained the sanction of the emperor to take off impressions from them, to be circulated in the country. The emperor consented, and in the third year of the period "Tschang-hing" of the reign of Ming-tsong, A.D. 932, the art of printing by means of stone plates began in China.

We have no accurate account of the process of this species of lithographic printing: all we know is, that the plate was blackened, and the characters were engraven on the stone in basso-rilievo, so that on the impression the paper was black and the letters white, which is still the case in China in all their lithographic printing. The stone plates, however, were soon superseded by wooden ones, which gave rise to the art of printing by means of plates of wood, in the same way as is still done with all their larger works. According to another writer, Fong-tao is stated to have commenced at once with the wooden blocks; and, in the annals of the later five dynasties, it is stated that Fong-tao (in the second year of the period "Tschang-hing" of Ming-tsong, of the later dynasty of Tang, A.D. 931) had solicited permission from the emperor to cut in wood and print, for the use of the pupils of the Imperial College, an edition of the nine King or classical works. He obtained the sanction, but the work was not finished till the second year of the period "Kuang-schun," the founder of the later Tscheu (A.D. 952).

Though this edition was intended for the pupils of the Imperial College, the emperor gave permission that any person in the empire might purchase a copy. The process pursued in the printing of this work by means of wooden plates has been carried on down to the present day without any essential alteration. The wood selected for these blocks is strong but not brittle; it is called Li, and resembles that of the pear-tree. From the Chinese accounts it is smooth and shining, and has a bitter flavour, on which account the worm never attacks it.

This process of wood engraving differed from the previous lithography employed inasmuch as all the letters and figures were worked in high relief; the wood being carefully cut and filed down all round them. The characters therefore, as with us, are black when printed, while the paper remains white. When we reflect on the great number of letters which compose the Chinese alphabet, the advantage of block printing is immediately obvious—and, in fact, it is the only method adapted for works of any magnitude. It is by this process that the Roman Catholic Missionaries in China have printed single pages and even entire works in the Latin and other European languages—such, for instance, as the Spanish and Chinese Grammar of P. Varo, and two books of Confucius—works which are among the greatest bibliographical curiosities in the world. The manner in which the Missionaries obtained these works, was by writing in a very legible hand upon transparent paper, which the Chinese wood engravers faithfully copied, without understanding a single word of the contents.

During the succeeding centuries various attempts were made to substitute moveable types for the wooden blocks, but they always terminated in a return to the old method. Under the great dynasty of Soong (A.D. 960—1280) an attempt was made to print by means of moveable types made of burnt earth, and the Emperor Kang-hi, of the present Mantschoo dynasty, had, according to Dr. Morrison, a great quantity of moveable types cast in copper. Kien-long, however, the second in succession to this wise prince, had all the types melted down during a period of great scarcity of money, in order to convert them into coin. In Dr. Morrison's extensive collection of Chinese books, there are a Chinese Dictionary, in 24mo., and a history of the Loo-Chew Islands, in four volumes, which were printed with these moveable types of Kang-hi's, but the characters are far inferior in beauty and regularity to those of the ordinary wood blocks. Kien-long subsequently, however, caused 250,000 moveable wooden types to be cut, which were then, and still continue to be, used in the printing of the 'State Calendar,' a work published every three months, and containing an account

of the different changes which have taken place among the Chinese officers of state, minor bulletins of the central government and local authorities, advertisements, &c. in which the same letters frequently occur. These types were universally imitated, and every considerable Chinese printing-office now possesses a large supply of them.

Various attempts have been made by Europeans, both in Asia and Europe, to print entire Chinese works by means of moveable wooden and metal types: the college of San Jose at Macao printed a Life of the Virgin, in two volumes, and a History of the Saints, in twenty-six; but they are far inferior in point of typographical execution to those printed in the ordinary Chinese fashion. Many pages are scarcely legible, which indeed is the case with the Chinese provincial papers printed with wooden types. The works which have been printed in English and Chinese, at the college founded at Macao by Dr. Morrison, by means of metal types, as well as the specimens of moveable Chinese letters cast some years ago under the direction of M. Pauthier at Paris, are everything that could be desired, though there is no hope of ever attaining in our metal types the ease and delicacy which the Chinese engravers impart to their wooden blocks. A Protestant missionary, the Rev. Mr. Milne, whose interesting labours were cut short by his premature death, states, in his history of the first ten years of the Protestant Mission in China, that the natives likewise make use of wax plates in printing. For this purpose they cover a wooden plate with wax two or three inches thick, into which they cut the letters with a graving needle, and then proceed to the printing in the same way as with the wooden plates.

The wooden plates are cut of a square form, each plate containing two pages, and they are raised about half a thumb. They are covered for some time with a greasy substance, which is thoroughly rubbed into the wood to render it more soft and easy for cutting. A caligraphist stands by, who writes the separate pages on fine tracing-paper; these he hands to the wood-cutter, who pastes it with the face downwards upon the wood while the oily matter is still moist: hereupon he cuts away with a sharp knife all those parts of the wood which are not covered by the writing. The Chinese printers have no notion of a real printing-press; and besides, their paper is so thin that it could not resist a hard pressure. The printer holds two very fine brushes in his right hand, of which one contains ink, and the other is dry. With the former he blackens all the letters; the latter he passes gently over the paper which has been laid on them. By this process a single man can with great ease print off several thousand sheets in a day. The Chinese paper is so exceedingly thin and transparent that it is printed on only one side. Every page is numbered, commonly also the title of the work, or of the book and chapter. Two pages are usually worked together, and the sheet of paper has a black line down the middle as a guide to the bookbinder, who folds it double, and fastens the open leaves together. Every volume is either gummed at the back with a very fine paste, or stitched with silk in a manner peculiar to the Chinese. Eight or ten of such volumes are then placed in a pasteboard case covered with coarse silk or cotton to keep them from dust. In the southern provinces of the empire books for ladies' libraries are bound in the European fashion in fine silks.

ON MOTHER-OF-PEARL.

This beautiful material has been as valuable to science, by furnishing confirmatory evidence of the truth of Newton's views respecting the origin of colour, as it has been to the manufacturer, in furnishing him with an elegant material for the formation of ornamental articles of various kinds.

Mother-of-pearl is the interior laminæ or scales of the shell of various fish living in the Indian Seas. The pearl oysters,* as they are called, exhibit the beautifully-variegated colours of mother-of-pearl; but it is a species of mussel called the *Mytilus Margaratiferus*, which affords the most exquisite specimens. That oyster-shells have a certain degree of resemblance on their interior surfaces to this substance we have every-day proof; for if we inspect the interior of a common oyster-shell we shall frequently find that it exhibits that rich play of tints which constitutes the beauty of mother-of-pearl; and, with respect to mussels, Réaumur remarked, in the early part of the last century, that the mussels caught off the coast of Provence had the interior of their shells variously tinted, one portion of each shell being pearl-like in its appearance.

The most beautiful specimens of mother-of-pearl are obtained from a species of mussel called the *peninim*, but it is too brittle to be employed in any large pieces of workmanship, for which reason a species called *dora* is preferred, of which great quantities are brought up the Red Sea to Jerusalem. An extensive manufacture is carried on at Jerusalem of small articles, such as crucifixes, wafer-boxes, beads, &c., which are carried in large quantities to the Catholic countries of South America. The position of Jerusalem at the east end of the Mediterranean gives it many facilities for this purpose, as it is very near the spot from whence the greater portion of the mussels are brought.

Mother-of-pearl, being of a scaly, laminated structure, is susceptible of being separated into a number of thin films, each surface of which presents the beautifully-coloured appearance which is so familiar to us. This separation is effected by means of aqua-fortis, or nitric acid, or else by cutting-engines employed by the lapidary. When the films are obtained in a state of great thinness they may be applied to a large variety of ornamental purposes, in the same way as tortoiseshell or the veneers of fancy woods are employed. Handles for penknives, combs, snuff-boxes, buttons, spoons, counters for card-playing, inlaying for work-boxes and dressing-cases, &c., are a few of the forms in which it is presented to us.

It admits of being cut into various ornamental forms, without much difficulty, a sharp-cutting instrument being sufficient if the shell be very thin, and a fine saw if it be of greater thickness. Messrs. Jennings and Betteridge, of Birmingham, have devised an improved mode of cutting up the shell into various fanciful and elegant forms. The mother-of-pearl is divided into very thin laminæ, some, indeed, so thin as the one-hundredth of an inch. Devices or patterns are then drawn upon the films or plates with opaque turpentine varnish. The shell is then repeatedly brushed over with strong nitrous acid, by which the parts which have not been covered with the varnish are corroded or eaten away. Oil of turpentine is then employed to wash off the varnish, and there then appears in relief the device which had been drawn with the varnish.

If the devices thus marked upon a piece of mother-of-pearl are to be cut out, it can be done with a knife-edged tool, or with a fine frame-saw, as in cutting buhl-work. If several devices or ornaments are required of the same shape and size, a number of films of shell are glued together into a compact mass. The device is then drawn on one of the two exterior films, and the saw is employed to cut through the whole of them at one time. The mass is then put into warm water, by which the glue which was employed to cement the films becomes softened, and the various pieces separate one from another.

We must now speak of the most distinguishing feature of this beautiful substance: we mean the ever-varying tints of colour.

* See Penny Magazine, vol. ii., p. 174, and the present volume, p. 338.

No one can avoid being struck with the diversity and delicacy of these tints; but there appears to have been no attempt made to discover the cause of their production until Sir David Brewster took up the subject, which he did with great success, and added one to the long list of services which he has rendered to optical science.

Sir D. Brewster says: "If we take a plate of regularly-formed mother-of-pearl, having its two opposite surfaces ground flat (but not polished), and if, with the eye placed close to the plate, we view in it by reflexion a candle standing at the distance of a few feet, we shall observe a dull and imperfect image free from colour. This image is formed upon the ordinary principles of reflexion, and is faint and undefined, owing to the imperfect reflecting power of the ground surface. On one side of this imperfect image will be seen a brighter image, glowing with the prismatic* colours. On the outside of the prismatic image will be observed a mass of coloured light, nearly at the same distance beyond the prismatic image that the latter is from the common image. These three images are always in the same right line, but their distances from one another vary according to the direction in which they are viewed."

Now it was in making certain observations on the distances of these images from one another that Sir David Brewster unexpectedly lighted upon the cause of them. He had occasion to fix a piece of mother-of-pearl to a goniometer (an instrument for measuring angles), with a cement of rosin and bees'-wax. Upon removing it from the cement when in a hard state, by insinuating the edge of a knife and making it spring off, the plate of mother-of-pearl left a clean impression of its own surface; and he was surprised to observe that the cement had actually received the property of producing the colours which were exhibited by the mother-of-pearl. This unexpected phenomenon was at first attributed by him and by several gentlemen who saw the experiment to a very thin film of mother-of-pearl detached from the plate, and left upon the cement; but subsequent experiments convinced him that this was a mistaken opinion, and that the mother-of-pearl really communicated to the cement the properties which it possessed.

This circumstance sufficiently proved to Sir D. Brewster that the cause, whatever it might be, of the colours of mother-of-pearl, resided on the surface, and did not depend upon the chemical nature of the substance. In order, therefore, to discover what was the configuration of the surface, he applied a microscope with high magnifying powers to the surface, when he perceived a grooved structure, closely resembling, as he says, "the delicate texture of the skin at the top of an infant's finger, or the minute corrugations which are often seen on surfaces covered with varnish or oil paint." When the mother-of-pearl was regular in its structure the grooves were all parallel, and the reflected images of a candle appeared all in one straight line; but when they were tortuous or curved, the images of a candle were not in a straight line.

Here then was proof that the colours were produced by the effect of the grooves on the light reflected from the surface; for on applying the microscope to the wax, which exhibited the same colours, a similar assemblage of grooves was observed. A consideration of Sir Isaac Newton's theory of the causes of the colours of thin bodies (which is not of a nature to be introduced here) has made it demonstrable that the series of grooves breaks up a beam of light which falls upon them, into a number of separate parts, each of which is reflected to the eye from the bottom and sides of the little grooves, and assumes a particular colour according to the angle at which it is reflected.

This singularly beautiful appearance can be transferred to balsam of Tolu, or to gum-arabic, by allowing a thin film to be pressed and to solidify between two pieces of mother-of-pearl; or it may be communicated to a clean surface of lead, or to the fusible metal resulting from the compound of mercury and bismuth by hammering.

With respect to the fineness and number of these grooves different specimens of shell give very different results. Sometimes a magnifying power of six or eight times will render them readily perceptible; while in other instances 2000 grooves have been counted in the space of an inch; and in others, again, the number was wholly incalculable. What is very remarkable, is, that grinding will not obliterate these grooves. It might be supposed that as the grooves must be separated from one another by slight ridges, those ridges would be worn away in the process of grinding. But as the ridges wear down, so do the grooves also; so that, however thin the film may be rendered by grinding, the grooves, and the colours resulting from them, are still developed. If the surface have any scratches or dents, the bottoms and sides of the scratches are grooved, just as if the surface had been level.

If we view a candle through a thin film of mother-of-pearl, or of gum or balsam which has received the grooved impression, coloured images of the candle will be seen nearly as distinctly as when the light is reflected from its surface.

If a scientific statement be true, there are generally means for proving its applicability in more circumstances than one. Consequently, if the colours of mother-of-pearl are produced by grooves on its surface, any mechanical contrivance by which similar grooves may be produced on any substance ought to give similar results. This has been strikingly confirmed by Mr. Barton, of the Royal Mint. This gentleman has constructed an engine by which he can engrave on the surface of steel and other metals lines so exquisitely minute that from 2000 to 10,000 are included in a single inch. These surfaces, when viewed by daylight, present but few appearances of colour; but when the light of the sun or of gas-flames falls upon them, an extremely brilliant display of colours is the result:—every gradation of tint is exhibited, and a change is produced by every motion of the object or of the source of illumination. This ingenious invention has been taken advantage of for the construction of various fancy articles, under the name of "Iris Ornaments" (from *iris*, a rainbow). Steel dies are engraved in this manner; from which several impressions may be taken on other substances.

* The term *prismatic* is applied to a series of colours which follow the order observed on viewing an object through a triangular piece of glass called a prism: this order is red, orange, yellow, green, blue, indigo, and violet. The colours of the *rainbow* are prismatic.

Roadside Groups.—In all the countries of the world groups by the wayside are the most eloquent of pictures. The traveller who lets himself be whirled past them, unobservant or unrecording, loses more than any devices of inquiry at his inn can repair. If he can sketch, he should rarely allow a characteristic group of persons or nook of scenery to escape his pencil. If he cannot use the pencil, a few written words will do. Two lines may preserve for him an exemplification which may be of great future value.—The farmers' wives of New England, talking over the snake-fence at sunset, are in themselves an illustration of many things; so is the stern Indian in his blanket-cloak, standing on a mound on the prairie; so is the chamois-hunter on his pinnacle, and the pedestrian student in the valleys of the Hartz, and the pine-cutters on the steeps of Norway, and the travelling merchant on the dyke in Holland, and the vine-dressers in Alsace, and the beggars in the streets of Spanish cities, and all the children of all countries at their play.—*How to Observe: Morals and Manners.* By Harriet Martineau.

*** The Office of the Society for the Diffusion of Useful Knowledge is at 59, Lincoln's Inn Fields.

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